10/088998 JC05 Rec'd PCT/PTO 26 MAR 2002

FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

# TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

| ATTORNEY'S DOCKET NUMBER | U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR |
|---|---|
| R.36041 | 10/088998 |

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |
|---|---|---|
| PCT/DE 00/03405 | 29 September 2000 | 30 September 1999 |

TITLE OF INVENTION

**Apparatus For Aftertreating Exhaust Gases Of An Internal Combustion Engine**

APPLICANT(S) FOR DO/EO/US

**Frisch, Walter Huber, Sven Krah, Juergen Mayer, Hanspeter Offenhuber, Michael Sachsenhofer, Robert Weiss, Roland Foetschl, Markus Schwarz, Roland Hoepflinger, Gerald**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☒ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

**Items 13 to 20 below concern document(s) or information included:**

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

**Transmittal Sheets in duplicate w/fees charged to Dep.Acct. 07-2100; Copy of German Text Appl.w/3 sheets drawings; German Text Amended Pages; Translation of German Text Appl and Amended Pages w/3 sheets drawings; Preliminary Amendment; Copy of PCT/RO/101; PCT/ISA/210/220; PCT/IPEA/401/409/416; Executed Declaration (not enclosed) Assignment to Robert Bosch GmbH (not enclosed).**

| U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR) | INTERNATIONAL APPLICATION NO. | ATTORNEY'S DOCKET NUMBER |
|---|---|---|
| 10/088998 | PCT/DE 00/03405 | R.36041 |

24. The following fees are submitted:.

**BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5)) :**

| | | CALCULATIONS PTO USE ONLY |
|---|---|---|
| ☐ | Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... | **$1040.00** |
| ☒ | International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... | **$890.00** |
| ☐ | International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... | **$740.00** |
| ☐ | International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... | **$710.00** |
| ☐ | International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... | **$100.00** |

| | | |
|---|---|---|
| **ENTER APPROPRIATE BASIC FEE AMOUNT =** | **$890.00** | |
| Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)). | **$130.00** | |

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | | |
|---|---|---|---|---|---|
| Total claims | 6 - 20 = | 0 | x $18.00 | **$0.00** | |
| Independent claims | - 3 = | 0 | x $84.00 | **$0.00** | |
| Multiple Dependent Claims **(check if applicable)**. | | | ☐ | **$0.00** | |
| **TOTAL OF ABOVE CALCULATIONS =** | | | | **$1,020.00** | |
| ☐ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2. | | | | **$0.00** | |
| **SUBTOTAL =** | | | | **$1,020.00** | |
| Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). + | | | | **$0.00** | |
| **TOTAL NATIONAL FEE =** | | | | **$1,020.00** | |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐ | | | | **$0.00** | |
| **TOTAL FEES ENCLOSED =** | | | | **$1,020.00** | |
| | | | | **Amount to be: refunded** | $ |
| | | | | **charged** | $ |

a. ☐ A check in the amount of _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. **07-2100** in the amount of **$1,020.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **07-2100** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

**Ronald E. Greigg**
NAME

**31,517**
REGISTRATION NUMBER

**26 March 2002**
DATE

10088998 10/088998
JC13 Rec'd PCT/PTO 26 MAR 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Walter Frisch et al

Based on PCT/DE 00/03405

For: Apparatus for Aftertreating Exhaust Gases of an Internal Combustion Engine

**PRELIMINARY AMENDMENT**

Commissioner for Patents and Trademarks
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

**IN THE SPECIFICATION**

**Page 1,** between the title and paragraph [0001], insert the following:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 00/03405 filed on September 29, 2000.

[0000.6] BACKGROUND OF THE INVENTION

replace paragraph [0001] with the following amended paragraph:

[0001] Field of the Invention

replace paragraph [0002] with the following amended paragraph:

[0002] The current invention relates to an improved apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular urea or a urea/water solution.

insert the following new paragraph:

[0002.5] Description of the Prior Art

**Page 2,** after paragraph [0006], insert the new paragraphs:

[0006.4] DE 197 50 138 describes a urea metering system with a compressed air supply for atomization, in which a check valve is provided in the compressed air path provided for this.

[0006.6] DE 42 30 056 A1, for example, has disclosed the production of an aerosol, which is based on a reducing agent and the compressed air acting on it, in a mixing chamber. In this connection, the reducing agent and the air are supplied to the mixing chamber via separate lines.

**Page 3,** insert the following new paragraph:

[0007.5] SUMMARY OF THE INVENTION

replace paragraph [0008] for the following amended paragraph:

[0008] The object of the invention is to improve an exhaust gas aftertreatment apparatus of this generic type to such an extent that a contamination of the air supply line or an onboard compressed air system that communicates with it can be reliably prevented through the use of a compact design.

**Page 4,** delete paragraph [0011]:

replace paragraph [0012] with the following amended paragraph:

[0012] The means for preventing a reflux are embodied in the form of a check valve

disposed in the mixing chamber. A check valve of this kind, which is integrated into the mixing chamber, makes it possible to embody the apparatus according to the invention in a particularly compact manner, in particular by using a small elastic body such as an elastic tube or an elastomer valve body.

delete paragraph [0013];

**Page 5,** after paragraph [0016], insert the following new paragraph:

[0016.5] BRIEF DESCRIPTION OF THE DRAWINGS

replace paragraph [0018] with the following amended paragraph:

[0018] Fig. 1 is a block circuit diagram-style view of a system for aftertreatment of exhaust gases,

**Page 6,** after paragraph [0020], insert the following new paragraph:

[0020.5] DESCRIPTION OF THE PREFERRED EMBODIMENTS

replace paragraph [0021] with the following amended paragraph:

[0021] In Fig. 1, the reference numeral 1 refers to a urea tank from which a urea/water solution is aspirated by a supply pump 4 via a line 1a with a check valve 2 and a filter 3, which is embodied as a filter sieve, and is fed via another check valve 6 to a metering valve 7 of a mixing chamber 8. The metering valve 7 meters the required quantity of urea/water solution into a mixing chamber, which is labeled 9 in Fig. 2. A possible overflow quantity of the urea/water solution can be returned through a return line 12 to the urea tank 1 via a pressure regulator 5 and another check valve 11. A possibly necessary ventilation of the line 1a can be executed via a ventilation circuit with a ventilating valve 10.

replace paragraph [0022] for the following amended paragraph:

[0022] In addition, the reference numeral 20 refers to a compressed air tank from which compressed air can be introduced into the mixing chamber by means of a pressure controller 21, a 2/2-way valve 22, and a check valve 23. The provision of the check valve 23, which can be embodied for example as a ball valve for a flat seat valve, can prevent a reflux of a reducing agent/air mixture from the mixing chamber into the compressed air line 24. In comparison to conventional systems, this sharply reduces the danger of a contamination of an on-board compressed air system that communicates with the compressed air line 24. Check valves of this kind, which can be embodied, for example, as ball valves or flat seat valves, are very inexpensive to procure and use, and have proven to be rugged and dependable.

**Page 7,** replace paragraph [0024] with the following amended paragraph:

[0024] With the aid of the described valves, the control unit 40 regulates the pressure in the compressed air line 24 and also monitors the urea/water solution pressure. The control unit 40 detects deviations and errors, stores them, and displays them on a diagnostic apparatus (not shown), for example a PC.

**Page 8,** replace paragraph [0027] with the following amended paragraph:

[0027] Another preferred embodiment of a check valve that can be used in the apparatus according to the invention or the mixing chamber according to the invention will now be described in conjunction with Fig. 3. In this connection, Fig. 3a gives a sectional view and Fig. 3b gives a perspective, exploded view of the check valve. The essential item of the check valve shown in Fig. 3 is an elastomer valve

body 34, which rests with a sealing lip 35 in an airtight fashion against the inner wall 36 of a valve housing 46. It is likewise possible for the sealing lip 35 to rest directly against the inner wall of the compressed air line, as has been described in conjunction with Fig. 1. When air flows in from the air line 24, the valve opens; when there is a reflux of air, the valve closes.

**Page 9,** insert the following new paragraph:

[0029] The foregoing relates to preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.

**Page 10,** delete "New Claims" and insert --We Claim--.

**IN THE CLAIMS**

Please cancel claims 1-6 and add new claims 7-12.

7. An apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular a urea or a urea/water solution, the apparatus comprising

a mixing chamber (8) into which a reducing agent, which is stored in a reducing agent tank (1), can be introduced via a reducing agent line (1a) and into which compressed air, which is contained in a compressed air tank (20), can be introduced via a compressed air line (24), in order to produce a reducing agent/air mixture, and

a check valve for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber (8) into the compressed air line (24),

the check valve (14, 15; 70) being disposed in the mixing chamber (8) and having an elastic body (34, 14) whereby when pressure is exerted on the elastic body in the compressed air supply direction, the elastic body permits compressed air to pass from the compressed air line into a mixing tank of the mixing chamber and when pressure is exerted in the opposite direction, the elastic body prevents the reflux.

8. The apparatus according to claim 7, wherein the elastic body is an elastic tube (14).

9. The apparatus according to claim 7, wherein the elastic body is an elastomer valve body (34) and that the elastomer valve body has a sealing lip (35), which rests

in an airtight fashion against an inner wall of a valve housing (46) or the compressed air line (24).

10. A mixing chamber for producing a reducing agent/air mixture, in particular an aerosol, for aftertreating exhaust gases of an internal combustion engine, the mixing chamber comprising

a mixing tank (9) into which a reducing agent can be introduced via a reducing agent line (1a) and compressed air can be introduced via a compressed air line (24), and

a check valve (14, 15, 70) for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber into the compressed air line,

the check valve having an elastic body (14, 34) whereby, when pressure is exerted on it in the compressed air supply direction, the elastic body permits compressed air to pass from the compressed air line into a mixing tank of the mixing chamber and when pressure is exerted on it in the opposite direction, the elastic body prevents the reflux.

11. The mixing chamber according to claim 10, wherein the elastic body is an elastic tube (14).

12. The mixing chamber according to claim 10, wherein the elastic body is an elastomer valve body (34) and that the elastomer valve body has a sealing lip (35), which rests in an airtight fashion against an inner wall of a valve housing (46) or the compressed air line (24).

**IN THE ABSTRACT**

Please substitute the attached Abstract of the Disclosure for the abstract as originally as filed.

**REMARKS**

The above amendments are being made to place the application in better condition for examination.

Entry of the amendment is respectfully solicited.

Respectfully submitted,

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**Page 12,** replace the abstract for the following new abstract of the disclosure:

ABSTRACT OF THE DISCLOSURE

An apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular a urea or a urea/water solution, having a mixing chamber into which a reducing agent, which is stored in a reducing agent tank, can be introduced via a reducing agent line and into which compressed air, which is contained in a compressed air tank, can be introduced via a compressed air line, in order to produce a reducing agent/air mixture, and having means for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber into the compressed air line.

## VERSION WITH MARKINGS TO SHOW CHANGES MADE

### IN THE SPECIFICATION

**Page 1,** paragraph [0001] has been amended as follows:

[0001] Field of the Invention [Prior Art]

paragraph [0002] has been amended as follows:

[0002] The current invention relates to an improved apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular urea or a urea/water solution[, as generically defined by the preamble to claim 1].

**Page 3,** paragraph [0008] has been amended as follows:

[0008] The object of the invention is to improve an exhaust gas aftertreatment apparatus of this generic type to such an extent that [it reliably prevents contamination of the air supply line or an on-board compressed air system that communicates with it] a contamination of the air supply line or an onboard compressed air system that communicates with it can be reliably prevented through the use of a compact design.

**Page 4,** paragraph [0012] has been amended as follows:

[0012] [According to a preferred embodiment of the apparatus according to the invention, the means for preventing a reflux are embodied as a check valve disposed in the compressed air line. Check valves of this kind, which can be embodied, for example, as ball valves or flat seat valves, are very inexpensive to

procure and use, and have proven to be rugged and dependable] The means for preventing a reflux are embodied in the form of a check valve disposed in the mixing chamber. A check valve of this kind, which is integrated into the mixing chamber, makes it possible to embody the apparatus according to the invention in a particularly compact manner, in particular by using a small elastic body such as an elastic tube or an elastomer valve body.

**Page 5,** paragraph [0018] has been amended as follows:

[0018] Fig. 1 is a block circuit diagram-style view of a [first preferred embodiment of the apparatus according to the invention] system for aftertreatment of exhaust gases,

**Page 6,** paragraph [0021] has been amended as follows:

[0021] In Fig. 1, the reference numeral 1 refers to a urea tank from which a urea/water solution is aspirated by a supply pump 4 via a line 1a with a check valve 2 and a filter 3, which is embodied as a filter sieve, and is fed via another check valve 6 to a metering valve 7 of a mixing chamber 8. The metering valve 7 meters the required quantity of urea/water solution into a mixing [tank] chamber, which is labeled 9 in Fig. 2. A possible overflow quantity of the urea/water solution can be returned through a return line 12 to the urea tank 1 via a pressure regulator 5 and another check valve 11. A possibly necessary ventilation of the line 1a can be executed via a ventilation circuit with a ventilating valve 10.

paragraph [0022] has been amended as follows:

[0022] In addition, the reference numeral 20 refers to a compressed air tank from

which compressed air can be introduced into the mixing chamber by means of a pressure controller 21, a 2/2-way valve 22, and a check valve 23. The provision of the check valve 23, which can be embodied for example as a ball valve for a flat seat valve, can prevent a reflux of a reducing agent/air mixture from the mixing chamber into the compressed air line 24. In comparison to conventional systems, this sharply reduces the danger of a contamination of an on-board compressed air system that communicates with the compressed air line 24. Check valves of this kind, which can be embodied, for example, as ball valves or flat seat valves, are very inexpensive to procure and use, and have proven to be rugged and dependable.

**Page 7,** paragraph [0024] has been amended as follows:

[0024] With the aid of the described [solenoid] valves, the control unit 40 regulates the pressure in the compressed air line 24 and also monitors the urea/water solution pressure. The control unit 40 detects deviations and errors, stores them, and displays them on a diagnostic apparatus (not shown), for example a PC.

**Page 8,** paragraph [0027] has been amended as follows:

[0027] Another preferred embodiment of a check valve that can be used in the apparatus according to the invention or the mixing chamber according to the invention will now be described in conjunction with Fig. 3. In this connection, Fig. 3a[)] gives a sectional view and Fig. 3[)] gives a perspective, exploded view of the check valve. The essential item of the check valve shown in Fig. 3 is an elastomer valve body 34, which rests with a sealing lip 35 in an airtight fashion against the inner wall 36 of a valve housing 46. It is likewise possible for the sealing lip [15] 35

to rest directly against the inner wall of the compressed air line, as has been described in conjunction with Fig. 1. When air flows in from the air line 24, the valve opens; when there is a reflux of air, the valve closes.

**Page 12,** abstract of the disclosure:

[Abstract] ABSTRACT OF THE DISCLOSURE

An apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular a urea or a urea/water solution, having a mixing chamber into which a reducing agent, which is stored in a reducing agent tank, can be introduced via a reducing agent line and into which compressed air, which is contained in a compressed air tank, can be introduced via a compressed air line, in order to produce a reducing agent/air mixture, and having means for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber into the compressed air line.

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JC13 Rec'd PCT/PTO 26 MAR 2002

# Apparatus for Aftertreating Exhaust Gases of an Internal Combustion Engine

[0001] Prior Art

[0002] The current invention relates to an apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular urea or a urea/water solution, as generically defined by the preamble to claim 1.

[0003] As a result of the need to comply with ever more stringent emission standards in recent years, numerous apparatuses and processes have been developed for aftertreatment of exhaust gases in internal combustion engines. Efficient exhaust gas aftertreatment systems have been achieved, for example by means of catalytic converter systems, which use urea and/or ammonia as a reducing agent for $NO_x$ conversion.

[0004] In order to achieve a reduction of $NO_x$ components in exhaust gas, reduction catalytic converters have been developed, particularly for diesel engines, which are usually divided into so-called SCR converters (selective catalytic reduction) with a urea metering system and reservoir catalytic converters. The so-called SCR converters are generated by means of a supply of urea and/or ammonia reducing agent, while the so-called reservoir catalytic converters are regenerated with hydrocarbons of the conveyed internal combustion engine fuel in so-called rich phases of the exhaust gas.

[0005] EP-A-0381236 has disclosed a system, which uses the metered addition of ammonia as a reducing agent to remove nitrogen oxides from exhaust gases of a diesel engine. This system is also provided with a turbocharger, which reduces the pressure of the exhaust gas. A urea/water solution used is metered in by means of compressed air.

[0006] DE-A-44 41 261 has disclosed an apparatus for aftertreating exhaust gases of an internal combustion engine, which is intended to improve the capacity of the catalytic converter by means of a metering device. The metering device is embodied as an extremely low-quantity metering positive-displacement pump, which has a thread in the form of a groove on a cylindrical rotation body, where in order to change the delivery capacity, the rotation body is driven at a variable speed. The addition of the reducing agent into the exhaust gas system preferably takes place in a characteristic field-dependent manner, i.e. as a function of the quantity and/or composition of the exhaust gas.

[0007] DE 42 30 056 A1, for example, has disclosed the production of an aerosol, which is based on a reducing agent and the compressed air acting on it, in a mixing chamber. In this connection, the reducing agent and the air are supplied to the mixing chamber via separate lines. During a metering operation, pressure fluctuations and turbulence can occur in the mixing chamber, which can cause a reflux of reducing agent, for example an aqueous urea solution, into the compressed air line. For

example in motor vehicles, since the compressed air used is taken from an on-board compressed air system, such a reflux of the reducing agent into the compressed air line can lead to a contamination of the entire on-board compressed air system. This can cause damage to a compressed air brake system, for example due to the corrosive action of a urea/water solution.

[0008] The object of the invention is to improve an exhaust gas aftertreatment apparatus of this generic type to such an extent that it reliably prevents contamination of the air supply line or an on-board compressed air system that communicates with it.

[0009] This object is attained by means of an apparatus with the features of claim 1 and a mixing chamber with the features of claim 6.

[0010] The measure according to the invention of supplying means for preventing a reflux of air or a reducing agent/air mixture from the mixing chamber into the compressed air line effectively prevents contamination of the compressed air line and of the on-board compressed air system. It is therefore possible, for example, to act on the air in the compressed air with a pressure that is relatively low in comparison to conventional designs.

[0011] Advantageous embodiments of the apparatus according to the invention and the mixing chamber according to the invention are the subject of the dependent claims.

[0012] According to a preferred embodiment of the apparatus according to the invention, the means for preventing a reflux are embodied as a check valve disposed in the compressed air line. Check valves of this kind, which can be embodied, for example, as ball valves or flat seat valves, are very inexpensive to procure and use, and have proven to be rugged and dependable.

[0013] According to a particularly preferred embodiment of the apparatus according to the invention, the means for preventing a reflux are embodied as a check valve disposed in the mixing chamber. A check valve of this kind, which is integrated into the mixing chamber, makes it possible to embody the apparatus according to the invention in a particularly compact manner.

[0014] The check valve disposed in the mixing chamber suitably has an elastic tube slid onto the valve body, where the tube is pervious or impervious, depending on the direction in which the pressure is exerted on the valve. A check valve of this kind, whose tube can be comprised of a silicone material, for example, is very small and can be easily replaced.

[0015] According to another preferred embodiment of the apparatus according to the invention, the check valve has an elastomer valve body, which rests with a sealing lip in an airtight manner against an inner wall of the valve housing or the compressed air line. A check valve of this kind is also very small, inexpensive, and has proven to be rugged and dependable.

[0016] According to a preferred embodiment of the mixing chamber according to the invention, the check valve has an elastic tube, which is slid onto a valve body; when pressure is exerted on it in the compressed air supply direction by means of the compressed air, the tube permits compressed air to pass from the compressed air line into the mixing chamber and when pressure is exerted on it in the opposite direction by means of the reducing agent/air mixture in the mixing chamber, the tube prevents this mixture from traveling into the compressed air line.

[0017] Preferred embodiments of the apparatus according to the invention and of the mixing chamber according to the invention will now be explained in detail in conjunction with the accompanying drawings.

[0018] Fig. 1 is a block circuit diagram-style view of a first preferred embodiment of the apparatus according to the invention,

[0019] Fig. 2 is a sectional side view of a preferred embodiment of the mixing chamber according to the invention, and

[0020] Fig. 3 shows another preferred embodiment of a check valve that can be used according to the invention, in a side view and a perspective view.

[0021] In Fig. 1, the reference numeral 1 refers to a urea tank from which a urea/water solution is aspirated by a supply pump 4 via a line 1a with a check valve 2 and a filter 3, which is embodied as a filter sieve, and is fed via another check valve 6 to a metering valve 7 of a mixing chamber 8. The metering valve 7 meters the required quantity of urea/water solution into a mixing tank, which is labeled 9 in Fig. 2. A possible overflow quantity of the urea/water solution can be returned through a return line 12 to the urea tank 1 via a pressure regulator 5 and another check valve 11. A possibly necessary ventilation of the line 1a can be executed via a ventilation circuit with a ventilating valve 10.

[0022] In addition, the reference numeral 20 refers to a compressed air tank from which compressed air can be introduced into the mixing chamber by means of a pressure controller 21, a 2/2-way valve 22, and a check valve 23. The provision of the check valve 23, which can be embodied for example as a ball valve or a flat seat valve, can prevent a reflux of a reducing agent/air mixture from the mixing chamber into the compressed air line 24. In comparison to conventional systems, this sharply reduces the danger of a contamination of an on-board compressed air system that communicates with the compressed air line 24.

[0023] By acting on the urea/water solution with the compressed air, an aerosol is produced in the mixing chamber 8, which is introduced into a catalytic converter 30 via an aerosol line 25. In this connection, a control unit 40 detects signals that are received from an overarching motor control unit by means of a CAN data line 41 as well as the signals from pressure, temperature, and fill level sensors 50 to 55, whose operation is known and will not be discussed further here. Based on this information, the control unit 40 calculates a urea/water metering quantity, which is to be added to an exhaust gas flowing through the catalytic converter 30.

[0024] With the aid of the described solenoid valves, the control unit 40 regulates the pressure in the compressed air line 24 and also monitors the urea/water solution pressure. The control unit 40 detects deviations and errors, stores them, and displays them on a diagnostic apparatus (not shown), for example a PC.

[0025] A preferred embodiment of the mixing chamber according to the invention of the kind that can be used in the context of the apparatus according to the invention will now be described in conjunction with Fig. 2. In this mixing chamber 8, it is essential that the check valve is comprised of a silicone tube 14 or of a tube made of a similar elastic material, which is slid onto a valve body 15 and rests in a sealed fashion against the inner wall 16 of the mixing chamber 8. If compressed air flows from the compressed air line 24 into the nozzle bore 17 (a number

of these nozzle bores can be provided, distributed over the circumference), then the silicone tube 14 is pressed away from the inner wall 16 of the mixing chamber and the air can flow into a diffuser 18 and can travel on into the mixing tank 9 via an annular gap 19. In the mixing tank 9, the air mixes with the aqueous urea solution flowing out of the urea line 1a.

[0026] If a mixture reflux from the mixing chamber 13 into the diffuser 18 takes place during non-stationary operation or due to turbulence, then the silicone tube 14 is pressed tightly against the inner wall 16 of the mixing chamber and prevents the further reflux of the mixture into the compressed air line 24.

[0027] Another preferred embodiment of a check valve that can be used in the apparatus according to the invention or the mixing chamber according to the invention will now be described in conjunction with Fig. 3. In this connection, Fig. 3a) gives a sectional view and Fig. 3b) gives a perspective, exploded view of the check valve. The essential item of the check valve shown in Fig. 3 is an elastomer valve body 34, which rests with a sealing lip 35 in an airtight fashion against the inner wall 36 of a valve housing 46. It is likewise possible for the sealing lip 15 to rest directly against the inner wall of the compressed air line, as has been described in conjunction with Fig. 1. When air flows in from the air line 24, the valve opens; when there is a reflux of air, the valve closes.

[0028] For a universal application, the valve is preferably embodied as a valve cartridge 70, which is comprised of the valve body 34, the valve housing 46, and a valve cover 60.

Claims

1. An apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular a urea or a urea/water solution, having a mixing chamber (8) into which a reducing agent, which is stored in a reducing agent tank (1), can be introduced via a reducing agent line (1a) and into which compressed air, which is contained in a compressed air tank (20), can be introduced via a compressed air line (24), in order to produce a reducing agent/air mixture, characterized in that means are provided for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber (8) into the compressed air line (24).

2. The apparatus according to claim 1, characterized in that the means for preventing a reflux are embodied as a check valve (23, 50) that is disposed in the compressed air line (24).

3. The apparatus according to claim 1, characterized in that the means for preventing a reflux are embodied as a check valve (14, 15, 50) that is disposed in the mixing chamber (8).

4. The apparatus according to claim 3, characterized in that the check valve has an elastic tube (14) that is slid onto a valve body (15); when pressure is exerted on it in the compressed air supply direction, the tube (14) permits compressed air to pass from the compressed air line into a mixing tank (13) of the

mixing chamber (8) and when pressure is exerted on it in the opposite direction, the tube (14) prevents the reducing agent or reducing agent/air mixture from traveling from the pressure chamber into the compressed air line.

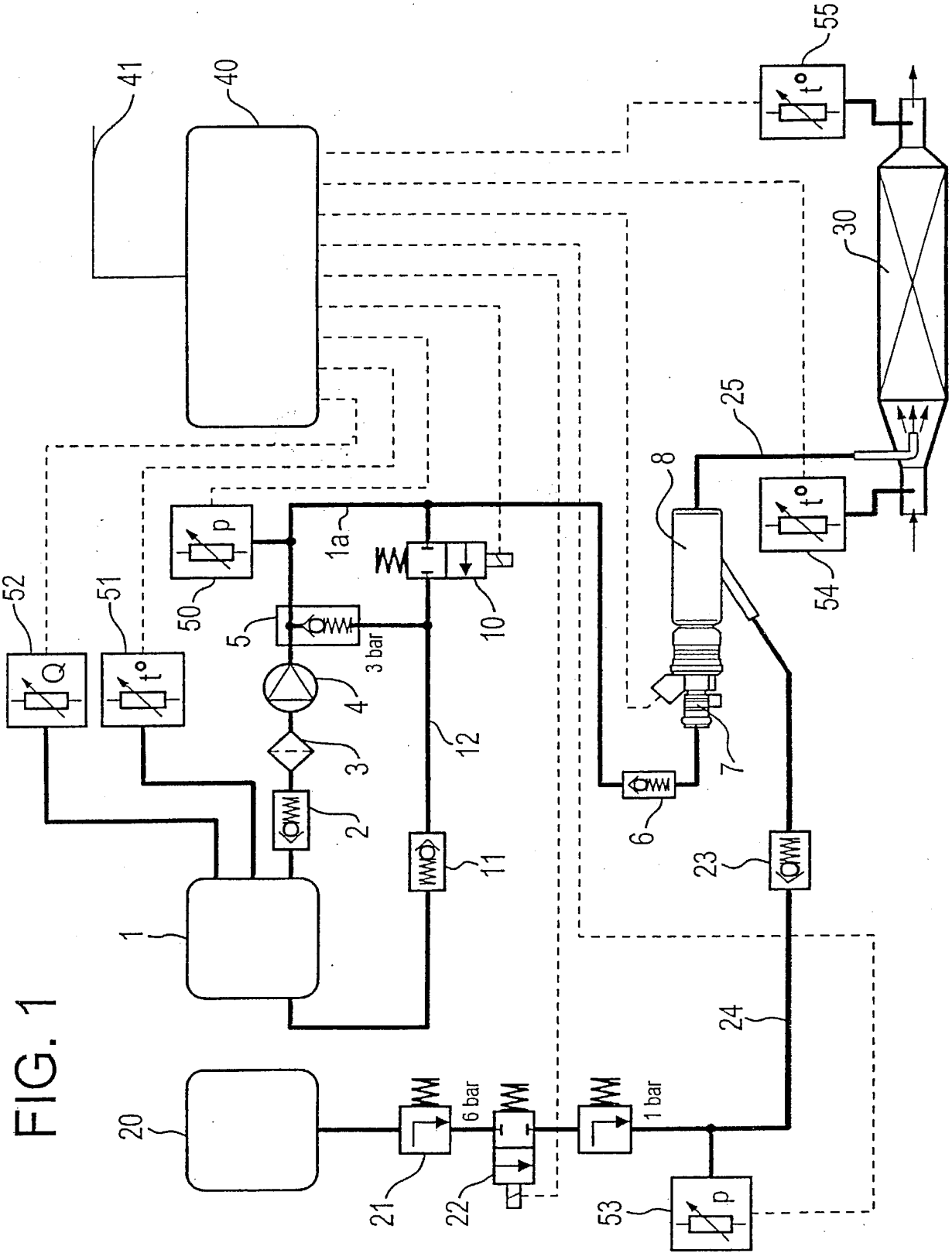
5. The apparatus according to claim 3, characterized in that the check valve (50) has an elastomer valve body (34), which rests with a sealing lip (35) in an airtight fashion against an inner wall of a valve housing (46) or the compressed air line (24).

6. A mixing chamber for producing a reducing agent/air mixture, in particular an aerosol, having a mixing tank (9) into which a reducing agent can be introduced via a reducing agent line (1a) and compressed air can be introduced via a compressed air line (24), characterized by means of a check valve (14, 15) for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing tank of the mixing chamber into the compressed air line.

7. The mixing chamber according to claim 6, characterized in that the check valve (14, 15) has an elastic tube (14) , which is slid onto a valve body (15); when pressure is exerted on it in the compressed air supply direction, the tube (14) permits compressed air to pass from the compressed air line into the mixing tank and when pressure is exerted on it in the opposite direction, the tube (14) prevents the reducing agent or reducing agent/air mixture from traveling into the compressed air line (24).

## Abstract

An apparatus for aftertreating exhaust gases of an internal combustion engine through the use of a reducing agent to be introduced into the exhaust gas, in particular a urea or a urea/water solution, having a mixing chamber into which a reducing agent, which is stored in a reducing agent tank, can be introduced via a reducing agent line and into which compressed air, which is contained in a compressed air tank, can be introduced via a compressed air line, in order to produce a reducing agent/air mixture, and having means for preventing a reflux of the reducing agent or reducing agent/air mixture from the mixing chamber into the compressed air line.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20
24
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1 bar
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53
p

FIG. 1

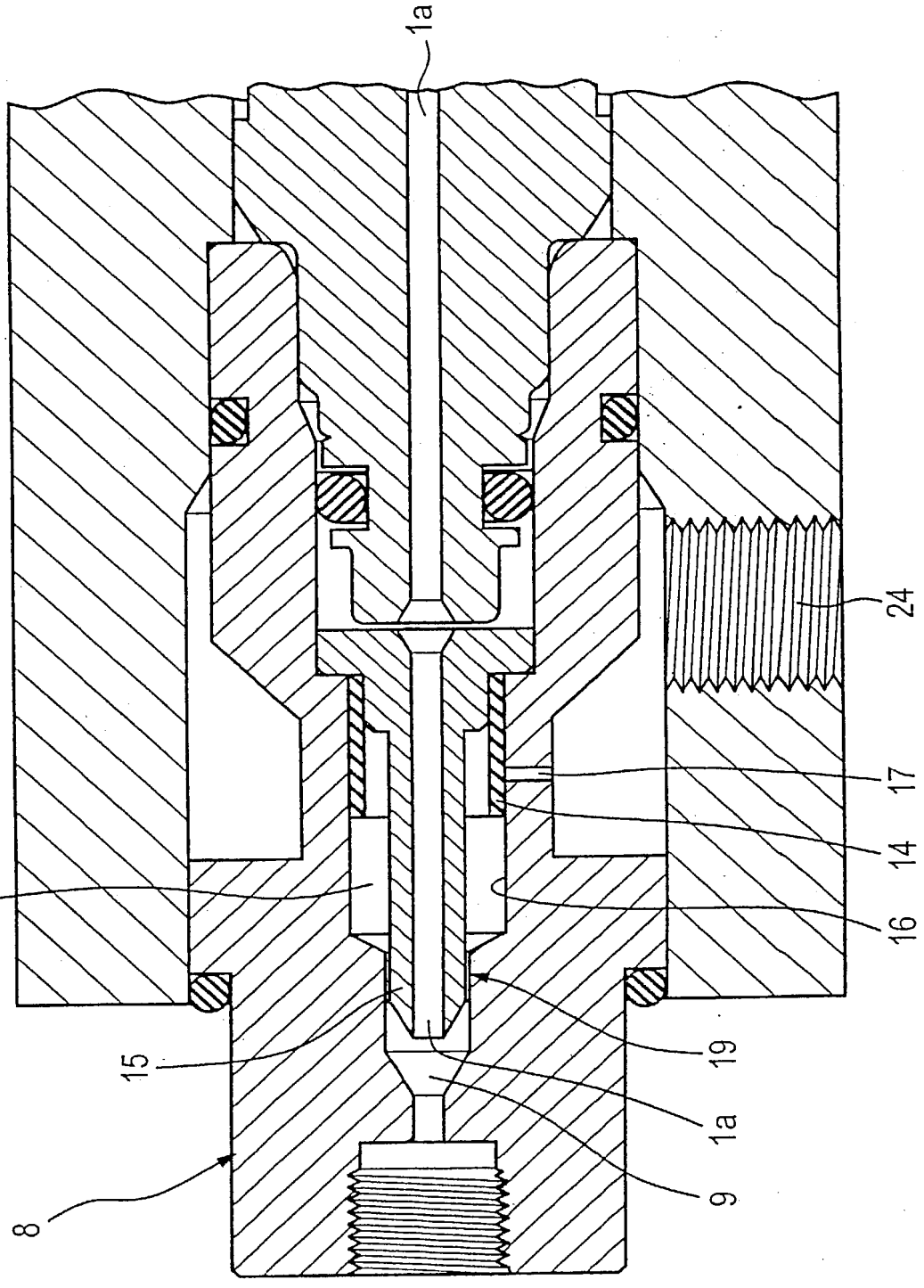



FIG. 2

FIG. 3a

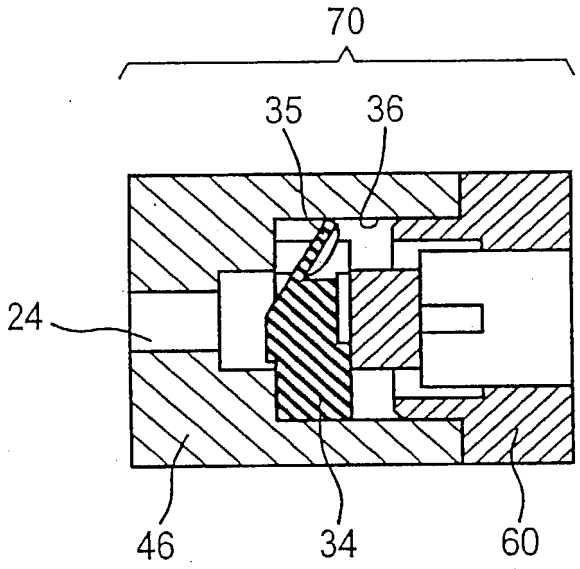



FIG. 3

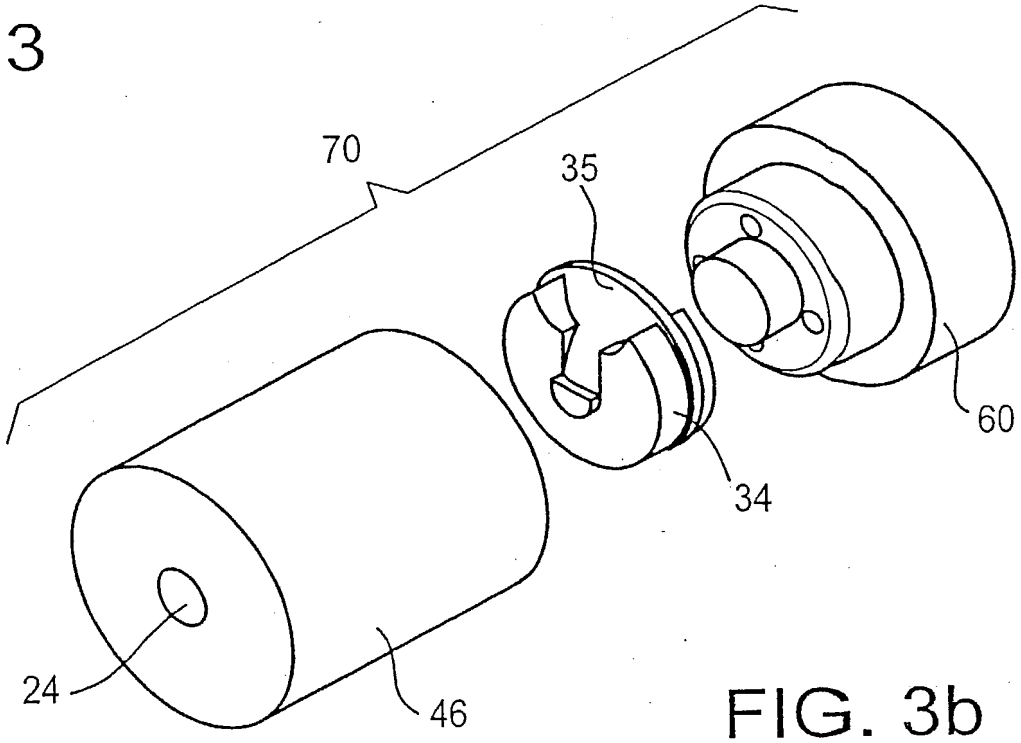



FIG. 3b

Docket No.
R.36041

# Declaration and Power of Attorney For Patent Application

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

APPARATUS FOR AFTERTREATING EXHAUST GASES OF AN INTERNAL COMBUSITON ENGINE

the specification of which
(check one)

☐ is attached hereto.

☒ was filed on September 29, 2000 as United States Application No. or PCT International Application Number PCT/DE 00/ 03405

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

| Prior Foreign Application(s) | | | Priority Claimed |
|---|---|---|---|
| 1 99 46 902.4 | Germany | 30 September 1999 | ☒ |
| (Number) | (Country) | (Day/Month/Year Filed) | |
| (Number) | (Country) | (Day/Month/Year Filed) | ☐ |
| (Number) | (Country) | (Day/Month/Year Filed) | ☐ |

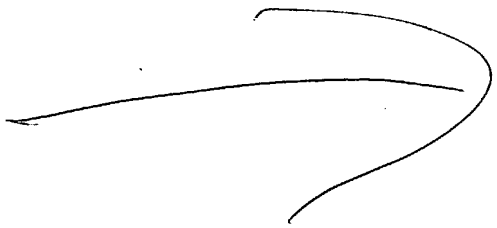
I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

| (Application Serial No.) | (Filing Date) |
|---|---|
| (Application Serial No.) | (Filing Date) |
| (Application Serial No.) | (Filing Date) |

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

| (Application Serial No.) | (Filing Date) | (Status) (patented, pending, abandoned) |
|---|---|---|
| (Application Serial No.) | (Filing Date) | (Status) (patented, pending, abandoned) |
| (Application Serial No.) | (Filing Date) | (Status) (patented, pending, abandoned) |

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



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